ABSTRACT FOR ISU SYMPOSIUM 1998 -- J.D. Burke, JPL and ISU   10 January 1998
Tele-services between Earth and Moon: Information flow to and from lunar settlements.

   In this paper let us examine the information flows between Earth's civilization and lunar settlements, founded in the 21st century and intended to grow productively thereafter. Information is the one valuable commodity instantly and cheaply transported between Earth and Moon, so all kinds of tele-services are likely to flourish once lunar settlements exist. We shall consider them in the light of the symposium questions: new developments in tele-health and tele-education, new tele-services using space technology, organizational structures, legal and regulatory frameworks, new scientific foundations, benefits and dangers, and lessons to be learned. Some relevant activities need not wait for a decision to found lunar cities; they can start now because they have merit already, even before an extension of our global village to the Moon. ISU should play an important role in this development.

   We begin with a brief review of natural limits controlling any kind of Earth-Moon communication, the main one being distance, ten times the range to geosynchronous orbit. Also, though Earth is nearly fixed in the sky as seen from the Moon, Earth's daily rotation dictates multiple ground stations, orbital relays, or both. For the wideband, multichannel information flows expected, optical links provide huge advantages and will undoubtedly be used. Maintaining reliable service in the presence of Earth's weather presents interesting technical and economic trade-offs whose solutions are likely to exist for other reasons long before they are needed for the lunar application.

   Next we examine likely types and rates of information flow, reasoning by analogy to what is already happening in intercity and international communications on Earth. Scientific, technical, business and entertainment communications, except those involving supercomputing, move at rates such that future radio and optical carriers will not constitute bottlenecks. However, the interconnections of those carriers, and particularly their costs and regulatory aspects, do limit services and so are drivers of technical, governmental, and economic change. The history of satellite relays and Internet growth is instructive, but it probably provides only a hint as to the complexity of the coming global village's nervous system. What does this mean with respect to lunar links? One obvious inference is that there will be a demand for enormously greater bandwidth, diversity and quality relative to the performance of the links used up to now for Apollo and other lunar missions, and used or planned for space stations. Going beyond technical matters there is the question of privacy and control: Already the Internet and many intranets are showing how controversial this can become. Once self-governing lunar settlements exist, similar problems are sure to arise.

   Finally we propose one application of Earth-Moon-Earth communications that is important now, need not wait for humans to return to the Moon, and could contribute greatly to the quality and safety of a two-world global village. This is to begin building, on the Moon, a retrievable, polyglot robotic archive of accumulated human knowledge and wisdom. This paper gives reasons for such a project, addresses its risks and benefits, presents it as part of a natural evolution toward the information flows that lunar settlements will need, and suggests a role in it for the International Space University.